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EFFECTIVENESS OF MANIPULATIVE -BASED INSTRUCTION AMONG GRADE 1 AND GRADE 2

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ABSTRACT

This study investigated the effectiveness of manipulative-based instruction (MBI) in improving the mathematical performance of Grade 1 and Grade 2 learners at Upper Atok Elementary School. Addressing the persistent challenge of low achievement and engagement among early elementary students in mathematics, the research sought to determine whether hands-on learning with concrete materials could bridge conceptual gaps and foster positive attitudes toward the subject. Employing a one-group pre-test post-test design and mixed-methods approach, the study involved the administration of standardized assessments and surveys to measure academic progress and behavioral changes before and after the intervention. Statistical analyses, including paired t-tests and descriptive measures, revealed significant gains in mathematical performance for both grade levels, with mean scores and proficiency levels rising substantially post-intervention. Qualitative feedback further indicated increased confidence, enjoyment, and engagement among students. The findings affirm that manipulative-based instruction serves as a vital cognitive bridge for young learners, supporting the transition from concrete experiences to abstract thinking. The study concludes that MBI not only enhances academic achievement but also cultivates positive learner dispositions, underscoring its significance as an effective instructional strategy in primary mathematics education.

Keywords: Manipulative-Based Instruction (MBI), mathematics, numeracy, learner engagement, instructional toolkit, academic performance, validation

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Introduction

Mathematics is one of the most important subjects in the elementary curriculum because it develops logical thinking, problem-solving, and life skills. For Grade 1 learners, mastering the four fundamental operations begins with addition and subtraction, which serve as the foundation for higher mathematical concepts. However, many pupils struggle with these basic skills, particularly those identified as having difficulties in mathematics. Weaknesses at this stage can hinder their progress in later grades and affect their overall academic performance. Extensive studies across diverse educational systems indicate that early mathematical proficiency is a significant predictor of later academic achievement and socio-economic outcomes (Duncan et al., 2007; Siegler et al., 2012). Evidence from international research further highlights that early intervention in mathematics, especially for struggling learners, is critical in preventing long-term learning gaps (Jordan et al., 2009; Clements & Sarama, 2008).

In the Philippines, the Department of Education has emphasized the importance of strengthening numeracy skills through the MATATAG Curriculum (Department of Education, 2023) and the National Mathematics Program (NMP) (Department of Education, 2018). These initiatives highlight the need to improve learners' number sense and computational fluency at the primary level. Despite these efforts, teachers continue to observe that some Grade 1 learners perform below expectations, often due to reliance on rote memorization and difficulty in understanding abstract mathematical symbols.

One instructional approach that has shown promise in addressing these challenges is manipulative-based instruction. Manipulatives—such as counters, blocks, and other concrete objects—help learners visualize and physically interact with mathematical concepts. Research has shown that using manipulatives enhances conceptual understanding, improves retention, and fosters positive attitudes toward mathematics (Moyer-Packenham & Westenskow, 2013; Carbonneau et al., 2013; Baroody & Purpura, 2017). By making abstract ideas more concrete, manipulatives can support low-performing learners in developing confidence and competence in basic operations.

At Upper Atok Elementary School, observations of the Grade 1 and Grade 2adviser revealed that several pupils continued to struggle in mathematics despite repeated instruction. This situation calls for innovative strategies that respond to the needs of low-performing learners. Thus, this study seeks to determine the effectiveness of manipulative-based instruction in improving the mathematical skills of these learners.

METHODOLOGY

This presents the research methods and procedures utilized in the study. It includes the research design, locale of the study, respondents of the study, research instrument, data gathering procedure, and statistical treatment of data to determine the effectiveness of Manipulative-Based Instruction among grade 1 and grade 2 learners.

Research Design

The study utilized One-Group Pre-test Post-test Design using single group. This design was used to measure the effect of an intervention (Manipulative-Based Instruction) on a single, total population of participants.

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The study also employed a mixed-method approach, in which data from the pre-test and post-test of a single group were analyzed (Shadish et al., 2002). This was followed by an analysis and test for significant difference between the pre-test and post-test.

Survey on the experiences of the of the respondents on the use of manipulative-based instruction was used to triangulate with the results of assessment conducted.

Locale of the Study

The study was conducted at Upper Atok Elementary School, Flora District. It is located in the heart of Upper Atok, Flora, Apayao. Upper Atok Elementary School is the only public elementary school in the barangay.

Respondents of the Study

The participants consisted of Grade 1 and Grade 2 learners from Upper Atok Elementary School during the School Year 2025-2026.

Table 1. *Respondents according to number gender*

Respondents	Grade 1	Grade 2
Male	10	4
Female	2	6
Total	12	10

Single group total population sampling was used to determine the respondents from Grade 1 and Grade 2. Since it was a multi-grade class, the total population was used.

Research Instruments

This research utilized a multi-faceted assessment framework to triangulate student progress. At the core was the Rapid Mathematics Assessment (RMA), a standardized diagnostic tool designed to pinpoint specific numeracy deficits in early childhood learners. This was supplemented by summative evaluations conducted on a fortnightly basis to quantify cumulative knowledge acquisition.

To capture the nuances of the learning process, the study integrated formative evaluation mechanisms, such as activity sheets and seatwork, which facilitated synchronous feedback and monitored the incremental development of the respondents. Finally, the assessment of 'higher-order thinking skills' and 'fluency' was achieved through authentic performance tasks. These instruments collectively measured the participants' capacity for contextual application and their mastery of procedural knowledge within the Grade 1 and 2 Mathematics curricula. These were used to guide the researcher in the development of the manipulative-based instruction as to its proper fit to the learners' context. The results served as the running records for the researcher to trace the track of the instruction.

An eight-item survey instrument adopted from Guillermo (2025) was used to capture the data needed for the experiences of the respondents (Guillermo, 2025).

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Data Gathering Procedure

The data gathering for this action research was conducted systematically across several phases to ensure comprehensive and accurate collection of both quantitative and qualitative data. All procedures strictly adhered to ethical guidelines, obtaining necessary permissions before implementation.

It is divided into different phases. Phase 1 is the Pre-Implementation and Baseline Data Collection. It includes Securing Permissions. Formal letters were prepared and submitted to the Schools Division Superintendent, the District Supervisor, and the School Head of Upper Atok Elementary School to secure their official approval and permission to conduct the study. Parental consent forms were distributed to and collected from the parents/guardians of all participating Grade 1 and 2 learners, clearly explaining the study's purpose, procedures, and assurance of confidentiality and voluntary participation.

Orientation of Participants included brief orientation session will be conducted for the Grade 1 pupils and their teachers to explain the study, their roles, and the nature of the intervention. This will help build rapport and ensure understanding.

The Rapid Mathematics Assessment was administered to gather baseline data in Mathematics. Data gathered were analyzed and tabulated.

Phase 2 was the grade 1 and 2 teacher undergone brief training sessions on the effective use of manipulatives into daily mathematics activities. This included strategies in implementing and using manipulatives. Collaborative planning sessions was held regularly to ensure consistent implementation and address any emerging concerns.

Implementation of the manipulative-based instruction was integrated into the daily Mathematics instruction of Grade 1 and 2 pupils from the administration of the Pre-Test of the Rapid Mathematics Assessment Tool to Post Test of the said tool.Teacher facilitated activities as collaboratively planned during Learning Action Cell Sessions, ensuring the use of chosen and correct manipulatives for specific learning competencies, active engagement strategies, and differentiated instruction for pupils at varying numeracy levels.

Under Phase 3 is the Post-Intervention Data Collection. Post-Assessment was conducted at the end of the intervention period. This allowed for a direct comparison of numeracy skills before and after the intervention.

The Phase 4 was the Data Consolidation and Analysis. All collected quantitative data from assessments were encoded and organized in a spreadsheet. Qualitative data from interviews and observation logs will be transcribed and systematically organized. Data analysis will then commence as outlined in the Data Analysis section of the research.

Statistical Treatment of Data

The collected data were subjected to both descriptive and inferential statistical analyses to address the research questions.

The quantitative data gathered from the Pre-test and post-test were subjected to descriptive and inferential statistical analyses to address the study's research questions. All statistical computations were performed using an appropriate statistical software package.

To answer the first two research questions, which concern the level of performance before and after the intervention, descriptive statistics were utilized.

The Mean {X} will be computed for both the Pre-test and Post-test scores. The mean represented the average performance level of the low-performing Grade 1 learners in addition and subtraction skills before and after the manipulative-based instruction.

The Standard Deviations were computed to determine the variability, or spread, of the scores around the mean, providing a measure of the homogeneity or heterogeneity of learners' performance.

Frequency and Percentage Distribution was employed to categorize the learners' scores into performance levels (e.g., Beginner, Developing, Proficient, Mastery) for a clearer interpretation of their academic standing.

To answer the third research question, which seeks to determine if the manipulative-based instruction had a significant effect, Inferential Statistics was applied.

The Paired Samples t-test was the most appropriate statistical tool for comparing the means of two sets of scores obtained from the same group of participants (Grade 1 and Grade 2 learners) under two conditions (Pre-test vs. Post-test).

This test was used to determine if there was a statistically significant difference between the learners' Pre-test scores and their Post-test scores.

The computation will test the null hypothesis that there is no significant difference between the Pre-test and Post-test means. The decision to reject the null hypothesis was based on comparing the computed t-value with the critical t-value at a predetermined level of significance, typically alpha = 0.05.

To address the final research question concerning the implications of the study's findings, a Qualitative Interpretation of the results was conducted. The results from the Paired Samples t-test were critically analyzed alongside the magnitude of the difference observed in the descriptive statistics.

These findings served as the basis for drawing evidence-based conclusions and for pedagogical implications to improve mathematics instruction and intervention strategies for low-performing Grade 1 and Grade 2 learners at Upper Atok Elementary School.

To determine the perceived behavioral effect of using MBI, the weighted mean was employed. This

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calculation allowed the researcher to compute an overall average score representing participation across indicators such as attentiveness, engagement, cooperation, and task completion. The weighted mean scores were then classified using the following mean range for meaningful interpretation:

Mean Range	Interpretation
1.00 – 1.66	Low Behavioral Effect
1.67 – 2.33	Moderate Behavioral Effect
2.34 – 3.00	High Behavioral Effect

This approach provided a clearer, more comprehensive understanding of how MBI influenced learners' behavior.

RESULTS AND DISCUSSION

This presents results from the data gathered. Discussion and thorough analysis of the results are also reflected.

Table 1. Level of performance of Grade 1 before and after MBI

Respondents	Pre- Test	Post Test	Score Increase
	Total Score: 35	Total Score: 35	
1	11	31	+20
2	13	34	+21
3	10	32	+22
4	8	26	+18

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5	17	34	+17
6	13	33	+20
7	7	25	+18
8	5	22	+17
9	12	30	+18
10	8	27	+19
11	13	31	+18
12	6	23	+17

Table 1 presents the comparative results of the pre-test and post-test scores of Grade 1 respondents to determine the effectiveness of Manipulative Based Instruction. The assessment utilized a 35-item test to measure the academic performance of twelve (12) respondents.

The data revealed a substantial increase in the scores of all respondents following the implementation of Manipulative Based Instruction.

During the pre-test, the scores ranged from a low of 5 for Respondent H to a high of 17 of Respondent E. The majority of the students scored below 15, indicating a low level of prior knowledge or mastery of the subject matter before the intervention.

In contrast, the post-test results show a dramatic upward shift, with scores ranging from 22 to 34. Notably, Respondent B and Respondent E achieved the highest score of 34 out of 35.

Every single respondent showed an improvement of at least 17 points. The highest growth was observed in Respondent C, whose score increased by 22 points (from 10 to 32).

The marked improvement between the pre-test and post-test scores suggested that Manipulative Based Instruction is a highly effective pedagogical tool for Grade 1 learners. The transition from low pre-test scores to high post-test scores implies that the use of physical or hands-on manipulatives helped bridge the gap in the students' understanding.

This significant leap in performance supports the theory that younger learners, particularly those in Grade 1, benefit immensely from concrete learning experiences. By engaging with instructional materials, they can touch and move, students were able to internalize concepts more effectively than through traditional instruction alone.

Developmental theorists such as Piaget and Bruner argue that young children are cognitively dependent on physical interaction with their environment to grasp abstract mathematical concepts. Because young learners are often in a stage of development where they think concretely, the use of physical objects—or manipulatives—serves as a necessary bridge for them to internalize information before moving toward formal, abstract reasoning.

Research consistently shows that MBI not only improves test performance but also increases student engagement and enjoyment, particularly for students who may find traditional worksheets discouraging. By activating multiple senses—including spatial and kinesthetic intelligences—manipulatives facilitate a deeper understanding, leading to stronger long-term retention of concepts (McNeil & Jarvin, 2007).

Manipulatives act as "analogies" or symbols for new, difficult ideas. They allow students to construct their own cognitive models, providing a common language that aids both student-teacher communication and student-student collaboration (Moyer, 2001). When students are provided with the opportunity to touch, move, and manipulate instructional materials, they are more capable of connecting these tangible experiences to their existing knowledge, which is essential for meaningful learning (Willingham, 2017).

Table 1.1 Mean and Standard Deviation of Grade 1 Scores

Test	Mean	Sd
Pretest	9.4	2.91
Posttest	19	4

Table 1.1 presents the mean scores and standard deviations of Grade 1 learners in the pre-test and post-test. The group's mean score rose significantly from 10.25 in the pre-test to 29.00 in the post-test, an impressive gain of 18.75 points. This sharp increase demonstrates the substantial impact of MBI on students' mastery of the lesson.

The standard deviation in the pre-test was 3.54, increasing slightly to 4.24 in the post-test. While this suggests minor variability in students' progress, the consistently low standard deviations indicate that improvement was experienced by the majority of learners. Manipulative Based Instruction benefited a wide spectrum of students, not only the high performers, as reflected in these results.

Collectively, these findings demonstrate that transitioning from abstract concepts to concrete, manipulative-based learning strategies is highly effective for Grade 1 learners. This aligns with research indicating that developmentally appropriate, hands-on experiences foster deeper conceptual understanding and retention among young students (Carbonneau et al., 2013; Sarama & Clements, 2009). The consistently high post-test performance further suggests that the intervention was both well-designed and suitable for this age group, supporting the growth of foundational mathematical skills.

These results imply that MBI is both effective and appropriate for Grade 1 learners, allowing them to visualize, interact with, and better understand mathematical concepts. The consistent gains across all evaluated criteria indicate the intervention's comprehensiveness and suitability for early elementary mathematics instruction.

This is supported by studies emphasizing that hands-on, manipulative approaches are essential

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for developing mathematical understanding and retention among young learners (Carbonneau et al., 2013; Sarama & Clements, 2009; National Mathematics Advisory Panel, 2008). The findings also align with research showing that comprehensive, learner-centered instructional materials foster engagement, participation, and achievement in foundational subjects. Thus, integrating MBI strategies into the early elementary curriculum is strongly recommended to promote meaningful learning experiences and sustained academic growth.

Table 2. Level of performance of Grade 2 before and after MBI

Respondents	Pre- Test	Post Test	Score Increase
	Total Score: 25	Total Score: 25	
1	9	22	+13
2	7	15	+8
3	6	13	+7
4	11	22	+11
5	13	22	+9
6	12	21	+9
7	8	19	+11
8	6	13	+7
9	8	19	+11
10	14	24	+10

Table 2 presents the pre- and post-intervention scores of ten Grade 2 learners on a 25-item mathematics assessment, administered to evaluate the impact of Manipulative Based Instruction (MBI).

Pre-intervention results indicated that most learners demonstrated limited proficiency, with baseline scores ranging from 7 to 13. This suggests foundational gaps in mathematical understanding prior to the implementation of MBI.

Post-intervention data revealed consistent and substantial improvement, as all learners achieved higher scores, ranging from 13 to 24. The most pronounced individual gain was an increase of 13 points, and notable progress was observed even among those with the lowest initial scores.

These findings provide empirical support for the efficacy of MBI as an instructional strategy in primary mathematics education. The results are congruent with existing literature, which emphasizes that manipulative-based and hands-on approaches enhance engagement, conceptual development, and retention among young learners (Carbonneau et al., 2013; Sarama & Clements, 2009; National Mathematics Advisory Panel, 2008).

Table 2.1 Mean and standard deviation of Grade 2 scores

Test	Mean	Sd
Pretest	9.4	2.91
Posttest	19	4

Table 2.1 further validated the effectiveness of the intervention through the mean score of the learners increased from 9.4 in the pre-test to 19.0 in the post-test. This indicates a total mean gain of 9.6 points, showing that the learners' collective understanding nearly doubled after the introduction of MBI.

The standard deviation increased from 2.91 in the pre-test to 4.00 in the post-test. This suggests that while all learners improved, the variation in scores widened slightly, as some students progressed to near-mastery at a faster rate than others.

These statistical results provide strong evidence that MBI significantly enhanced the academic performance of Grade 2 learners. The increase in mean score reflects a shift from low to proficient performance in relation to the 25-point scale. This finding aligns with the work of Sowell (1989), who found that students using manipulative materials showed greater mathematical achievement than those taught by traditional methods.

For Grade 2 students, who are in a transitional cognitive stage, the use of manipulatives reduces the cognitive load required to process abstract symbols. By providing a physical representation of the lesson, the instruction allowed for a more meaningful encoding of information. The significant increase in the mean score serves as evidence that this instructional strategy is an effective alternative to traditional lecture-based methods for improving student outcomes in the primary grades. This is consistent with the findings of Carbonneau, Marley, and Selig (2013), who concluded that manipulative-based interventions foster greater conceptual understanding and retention.

Table 3.1 t-test for the difference of the pre-test and post-test of Grade 1

Test	Mean	t-computed	t crit. value	Decision	Interpretation
Pre-test	10.25	11.75	1.72	reject null hypothesis	Significant
Post-test	29				

$*significant\ at\ \alpha = 0.05$

Table 3.1 presents the comparative analysis between the pre-test and post-test mean scores of the Grade 1 learners. The statistical analysis reveals a significant difference in the academic performance of Grade 1 learners after the intervention. The mean score increased significantly from 10.25 in the pre-test to 29.00 in the post-test. The computed t-value is 11.75, which is substantially higher than the critical t-

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tabular value of 1.72 at a 5% level of significance.

Since the t-computed value (11.75) exceeds the t-tabular value (1.72), the null hypothesis—which states that there is no significant difference between the pre-test and post-test scores—is rejected.

The results are interpreted as significant, meaning the increase in scores is directly attributable to the intervention rather than chance. The rejection of the null hypothesis provides strong statistical evidence that MBI is an effective intervention for Grade 1 learners. The high t-computed value indicates a very strong effect size, suggesting that the use of hands-on materials profoundly influenced the students' ability to understand and retain the lesson. This finding is consistent with Sowell (1989), who found that students using manipulatives demonstrate greater mathematical achievement, and with Carbonneau et al. (2013), who reported that manipulative-based interventions foster higher conceptual understanding.

This finding aligns with educational theories suggesting that concrete experiences are foundational for cognitive development in early childhood (Moyer, 2001; Furner & Worrell, 2017). By interacting with physical manipulatives, the Grade 1 learners were able to bridge the gap between abstract concepts and practical application, resulting in a statistically superior performance in their post-test evaluations. This is further supported by Uribe-Flórez and Wilkins (2010), who observed that teachers' effective use of manipulatives positively impacts student learning, and Suh et al. (2005), who emphasized the importance of multiple representations in mathematics education. Consequently, the data supports the integration of manipulative-based strategies as a primary tool for enhancing learning outcomes in the early grades.

Table 3.2 t-test for the difference of the pre-test and post-test of Grade 2

Test	Mean	t-computed	t crit. value	Decision	Interpretation
Pre-test	9.4	6.13	1.73	reject null hypothesis	Significant
Post-test	19				

$*significant\ at\ \alpha = 0.05$

Table 3.2 shows that Grade 2 mean scores improved significantly from 9.4 (pre-test) to 19.0 (post-test). The computed t-value of 6.13 exceeded the t-tabular value of 1.73 at the 5% significance level, leading to the rejection of the null hypothesis and confirming the instructional intervention's effectiveness (Sarama & Clements, 2009; Sowell, 1989).

Rejecting the null hypothesis confirms MBI is effective for Grade 2, even with more complex

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content. This supports prior findings that manipulatives enhance comprehension (Carbonneau et al., 2013).

The increase from 9.4 to 19.0 shows tactile materials helped students visualize concepts, reinforcing the value of a concrete foundation before abstract symbols (Carbonneau et al., 2013). Continued use of manipulatives is recommended.

The findings of this study demonstrated that MBI significantly enhances the academic performance of Grade 1 and Grade 2 learners. The statistical evidence, particularly the rejection of the null hypotheses, confirms this improvement is a direct result of the intervention rather than random chance.

The data shows a dramatic shift from low pre-test mastery to high post-test proficiency in both grade levels. For Grade 1, the mean score rose from 10.25 to 29.00 (out of 35). For Grade 2, the mean score nearly doubled from 9.4 to 19.0 (out of 25).

These results align with Piaget's Theory of Cognitive Development, specifically the Concrete Operational Stage. Piaget posits that children in early elementary years (ages 7–11) require concrete objects to perform mental operations and understand abstract concepts. By engaging with materials they can "touch and move," students internalize concepts more effectively than through traditional lecture-based methods.

The study reveals that manipulatives serve as a cognitive bridge. For Grade 2 students in a "transitional cognitive stage," these tools reduce the cognitive load required to process abstract symbols by providing a physical representation of the lesson.

Individual growth was as high as +22 points in Grade 1 and +13 points in Grade 2. Research by Sowell (1989) found that long-term use of manipulatives significantly increases student achievement when compared to instruction without them (Carbonneau et al., 2013). Similarly, Bruner's Enactive-Iconic-Symbolic (EIS) Framework suggests that learning must begin with "enactive" (hands-on) experiences before progressing to images (iconic) and eventually abstract symbols. Your findings support this, as the "concrete" foundation led to a "High Level of Performance" in post-test evaluations.

The low standard deviation and high t-computed values indicate that the intervention was consistently beneficial across the group. For Grade 1, the t-value is 11.75 versus 1.72 tabular. And for Grade 2, the t-value is 6.13 versus 1.73 tabular.

These results support studies recommending regular use of manipulatives for deeper understanding of mathematical concepts (Sarama & Clements, 2009). Strong effect sizes indicate hands-on materials improve retention and visualization.

Table 4. Perceived behavioral effects of using MBI among Grade 1 and Grade 2 learners

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No.	Statement	Level of Observed Behavior	Description
1	I find it easier to solve math problems when I touch and move the objects.	3	Frequently
2	Using the math tools makes me feel excited about the lesson.	3	Frequently
3	I understand the teacher's instructions better when I see the tools.	3	Frequently
4	I feel confident that I can get the right answer using the materials.	3	Frequently
5	I like working with my classmates while using the math tools.	3	Frequently
6	The math tools help me stay focused and pay attention to the lesson.	2.73	Frequently
7	I can explain my answer to the teacher by showing what I did with the tools.	2.73	Frequently
8	Using the materials makes math feel like a fun activity rather than hard work.	2.73	Frequently
OVERALL MEAN		**2.89**	Frequently

Table 4 presents the feedback from the Grade 1 and Grade 2 learners regarding their personal experiences and attitudes toward the use of Manipulative-Based Instruction. The survey results indicate a highly positive response to the use of manipulative-based instruction among Grade 1 and Grade 2 learners, with an overall weighted mean of 2.89, which falls under the "Frequently" category. All individual items in the survey also yielded ratings within this high-frequency range, with the highest scores (3.00) recorded for items related to ease of problem-solving, excitement, instructional clarity, confidence in finding correct answers, and enjoyment of collaborative work. Items concerning focus, ability to explain answers, and math being perceived as "fun" were rated at 2.73, reinforcing a consistently positive perception of the instructional approach.

The findings of this study demonstrate that integrating physical manipulatives into mathematics instruction effectively enhances learner engagement and self-efficacy in primary grade students. The data aligns with the constructivist theory of learning, which posits that children build mathematical knowledge by actively interacting with their environment rather than passively receiving information. By utilizing concrete tools, learners can construct their own cognitive models for abstract concepts, a process essential

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for developing deep, long-term mathematical understanding (Suh et al., 2005).

The high level of reported "excitement" and "fun" found in the survey results supports the notion that manipulatives serve as a powerful catalyst for engagement. Research has shown that when students interact with physical objects, they are better able to access their spatial and kinesthetic learning styles, which aids in information retention and reduces the intimidation factor often associated with abstract mathematics (National Council of Teachers of Mathematics, 2000).

Furthermore, the learners' reported confidence in explaining their answers using these tools is consistent with Piaget's theory of cognitive development. Students in the early primary grades typically reside in the "concrete operational stage," where logical thinking is most effectively developed through actions performed on physical objects. The manipulatives function as a "bridge" between the concrete and the abstract, allowing students to verify their reasoning and communicate their mathematical thought processes more clearly to both teachers and peers (Boggan et al., 2012; Dinsmoor, 2022).

Ultimately, these findings suggest that when manipulatives are incorporated intentionally, they not only facilitate the learning of specific concepts but also cultivate a more positive, student-centered classroom environment where young learners feel capable and focused.

Conclusions

Based on the thorough statistical analysis and interpretation of the data gathered, the following conclusions are drawn:

The use of MBI proved highly effective in improving the mathematical performance of Grade 1 and Grade 2 learners at Upper Atok Elementary School. The findings confirm that MBI provides an essential foundation for learners who struggle with traditional, abstract-only teaching methods.

MBI serves as a vital cognitive bridge, helping young learners move from hands-on activities to abstract thinking. This approach supports the development of key mathematical concepts and is effective for students in the concrete operational stage.

Finally, positive learner feedback shows that MBI enhances student engagement, confidence, and self-efficacy. Beyond academic improvement, MBI helps foster a more positive and lasting attitude toward mathematics among primary learners at Upper Atok Elementary School.

Recommendations

Based on the significant findings and conclusions of this study, the following recommendations are offered:

1. Teachers should use the EIS Framework, MBI, and manipulatives to help students master basic math skills. Let learners handle objects before moving to pictures and symbols to create an engaging math environment.
2. School administrators should fund math manipulatives, set up a Mathematics Laboratory Corner in classrooms, organize MBI training and mentoring for teachers, and hold sessions for parents on using household items as manipulatives.
3. The Department of Education (DepEd) may use the findings to develop localized instructional materials for the region and include MBI as a standard practice in teaching math in early grades.
4. Future researchers should assess the long-term retention of academic gains, compare the impact of virtual and physical manipulatives in rural settings, and analyze implementation challenges of MBI to

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inform practice.

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